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ATLANTIC REGION SEDIMENT ACTION PLAN

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ATLANTIC REGION SEDIMENT ACTION PLAN

THE NEXT THREE YEARS AND BEYOND ...

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ABSTRACT

The Atlantic Region Sediment Action Plan will serve as a guide for the management and operation of the Water Resources Branch sediment programme in the four Atlantic Provinces for the next three years. It gives an overview of the current sediment monitoring situation and provides a time frame for achieving limited changes to bring the existing practices more in line with the recently approved sediment national action plan.

To produce this document, recommendations from the Washburn & Gillis report "Freshwater Sediment Data Collection and Use in the Atlantic Region" and " Proceedings of Charlottetown Sediment Issues Workshop" were utilized, but only to the limit they meshed with the sediment national action plan and were compatible with available resources.

The implementation of several of the recommendations will depend to a large extent on outside factors such as co-operation with the provinces and interest in sediment issues from their part.

RÉSUMÉ

Le plan de travail sédimentologique de la Région de l'Atlantique va servir de guide aux gestionnaires et opérateurs du programme sédimentologique de la Direction des ressources en eau dans les quatre provinces de l'Atlantique. Il donne un apperçu de la situation actuelle en terme d'échantillonage des sédiments et fourni un échéancier pour implanter certains changements afin d'aligner les pratiques courantes avec celles véhiculées dans le plan de travail sédimentologique national récemment approuvé.

Ce document utilise des recommendations des rapports Washburn & Gillis "Freshwater Sediment Data Collection and Use in the Atlantic Region" et "Proceedings of Charlottetown Sediment Issues Workshop" mais seulement en autant que celles-ci soient compatibles avec le plan de travail sédimentologique national et les ressources disponibles.

La mise en oeuvre de plusieurs des recommendations va dépendre en gros sur des facteurs externes tels la collaboration des provinces . et l'intérêt qu'elles porteront aux questions sédimentologiques.

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USEFULL ACRONYMS AND ABBREVIATIONS

C & P: Conservation and Protection, Environment Canada

PWS: Pumped water sediment sampler used for automatic sampling

SAP: Atlantic Region three year sediment action plan

SAR: Station analysis report produced once station is discontinued

SMS: Sediment station management system

SNAP: Sediment national action plan

SSP: Sediment station profile

TAG: Technical advisory groups

TUNS: Technical University of Nova Scotia

USPS: United States pump sampler used for automatic sediment sampling

WQP: Water Quality Branch, Environment Canada

WRB: Water Resources Branch, Environment Canada

1. INTRODUCTION

There is a saying "Don't make a mountain out of a molehill." Maybe there should also be one which says "It's next to impossible to make a mountain out of a molehill." The sediment processes in this region are relatively minor and the issues remain few and isolated. For these reasons and the "no extra money guideline", any sediment action plan must be modest in scope and in results expected.

For the past 5 years, the Sediment Surveys Section of the Water Resources Branch has endeavoured to give new life to the national sediment monitoring programme. This task was undertaken in a period of budgetary restraint and therefore, precluded was any major expansion of the programme. Studies with a mandate to identify regional priorities in terms of sediment monitoring were produced in each region of the country. In the Atlantic Region, the engineering consultant firm of Washburn & Gillis was hired to produce such a report.

The report, "Freshwater Sediment Data Collection And Use in The Atlantic Region" (Sediment Report for short), provided management with an outsider's overview of the existing sediment monitoring programme and came up with 15 recommendations. One of these recommendations was to organize an Atlantic Region workshop on freshwater sediment issues. Such a workshop was organized and held in Charlottetown on June 26, 1986. This forum gave 22 participants the opportunity to make presentations on topics ranging from sediment control regulations to channel bed sampling. The workshop itself, through its proceedings, generated 19 recommendations.

The Sediment Report and the sediment issues workshop did not have as a term of reference to provide recommendations which could be implemented within the existing budget limits. For this reason, several of their recommendations such as operating a minimum of 35 base and secondary stations or setting up a mobile instrumentation laboratory are considered to be desirable but certainly not attainable, and therefore are not considered for future implementation.

The recommendations retained, along with the programme objectives in the recently approved national sediment plan have been taken into consideration to elaborate a regional strategy on sediment monitoring for the next three to five years. The strategy will be known as the regional Sediment Action Plan (SAP) and contains action items with three implementation target dates.

The SAP proposes three schedules of implementation:

- SHORT TERM GOAL: By March 31, 1989

- MEDIUM TERM .GOAL: By March 31, 1991

- LONG TERM GOAL: Beyond March 31, 1991

Goals with no set target date but which are expected to repeat or occur on a more or less regular basis will be identified as ONGOING.

2. SEDIMENT ACTION PLAN COMPONENTS

Implementing and operating a sediment monitoring programme require a three level approach. These levels are: management, operational, and research.

The management level addresses the implementation of a station management system (SMS), the rationalization of the region's sediment network, the implementation of Technical Advisory Group(s) (TAG), and the organizing of sediment workshops and seminars. It ensures adequate employee training is provided.

The operational level includes producing sediment station profiles (SSP) and station management plans (SMP) for the sediment stations, and producing station analysis reports (SAR) for stations identified for discontinuation. It also includes ensuring the correct use of equipment, instrumentation, and methodologies, in other words, quality assurance.

The last action category consists of meeting the regional research requirements for the sediment programme and participating in national efforts that relate to regional needs. This includes the development of research proposals, cooperating with the region's provinces, the academic community, and agencies such as the Water Quality Branch in specific "answers to issues" research projects.

3. MANAGEMENT RESPONSIBILITIES

3.1 Station Management System

Management will implement a sediment station management system (SMS) for all existing and new sediment stations in the Atlantic Region. The SMS, based on the one developed for the sediment national action plan (SNAP) embodies the whole process of managing a sediment station from begining to end. It will "enable a more systematic evaluation, planning, and operation of data collection activities." 1

1) - Sediment National Action Plan

The SMS will require for each active sediment station a sediment station profile (SSP), a yearly station management plan (SMP), the production of station or basin analysis reports (SAR) whenever a station is discontinued, and finally, a yearly assessment and update of the sediment monitoring programme based on the SMPs. See Figure I for a flow chart of the components of the SMS.

Over the last two years, the WRB Atlantic Hydrology Division has produced three SARs. Under the SMS, each of these reports would have been completed only once a SMP yearly review had shown a station should be discontinued. Since SMPs have yet to be produced for any of the sediment stations, implementation of the SAR recommendations will be defered until the SMPs have been completed for those three stations.

3.2 Rationalization of the Sediment Network

The Washburn & Gillis report on sediment issues proposed the Atlantic Region's sediment station network be expanded (doubled) but admitted this was just a "perceived figure". This proposal has not been adopted due to the increase in cost such an expansion would create. The report's other major recommendation relating to the network was the need to rationalize. This would include a better distribution of the sediment stations and a categorization of those stations according to their intended function. Five such categories were proposed but since no major expansion of the network is envisaged, stations will only be classified as either "base" or "project".

Water Resources Branch (WRB) will aim to operate the base stations on a 50/50 cost shared basis with the four Atlantic Provinces. Project stations will be operated on a cost recovery basis and funding would be required from the agency or the programme requesting such a station. An example of such a cost recovery would be an agreement with the Water Quality Branch (WQB) to monitor sediment as a carrier of nutrients and contaminants which could be used as an important indicator of aquatic environment quality. The Blanchford and Day report " Sediments in Water Quality Assessments" recognizes the WQB lead role in determining water quality and at the same time notes the WRB role in sediment data gathering. WQB would lead the way in such a sediment quality monitoring project or programme and WRB would follow in step with its data gathering capacity.

There has been a shift of emphasis with the sediment national action plan (SNAP) away from "collection for inventory purposes to a more balanced programme including studies relating to issues and projects". The Washburn & Gillis Sediment Report corroborates this perspective by indicating their survey identifies a movement away from the engineering aspects of sediment to more specific water quality and environmental questions. WRB Atlantic recognizes this change of emphasis and will co-operate to the fullest extent possible in issue related studies and projects.

Still, the main basis on which WRB can operate stations from a federal perspective is for the purpose of providing an overview of the sediment regime in the Atlantic Region. For this reason, it will work towards operating a minimal network of base stations to monitor suspended sediment. Generally speaking, WRB has not operated its gauging stations as part of a network but more or less on an ad hoc basis. An exception to this would be the sediment station distribution of recent years in New Brunswick.

The Atlantic Region is fragmented from both a geographical and a topographical point of view. The terrain features such as slope, soil type, and vegetation cover vary widely and rarely within clearly defined and extensive zones. Also, weather conditions vary considerably from one area to another, making it difficult to define sediment zones with any degree of consistency and uniformity without multiplying their number. The Ingledow report "Hydrometric Network Plan, 1970" attempted to delineate 23 sediment zones, following a rationale of determining both erodibility and erosive forces. See Figure II.

Some of the Ingledow delineations are to some degree arbitrary, and in one instance group into one zone, dissimilar areas such as the Cornwallis River valley and the Cobequid Highlands. It is possible to reduce the number of sediment zones to 15 by further combining some marginally different zones in Nova Scotia and PEI and by re-defining other zones using more up to date meteorological data (erosive forces) supplied by the Flood Frequency Analysis Study recently completed for the Province of Newfoundland. See Figure III, for a map of the new 15 sediment zone delineations and Table I for a distribution of the sediment zones per province. Unless specified otherwise, sediment zones in this report refer to the 15 zone delineation.

3.2.1 New Brunswick:

Currently, New Brunswick and Prince Edward Island have the best sediment station coverage in the Atlantic Region. Four of the six New Brunswick stations are funded on a cost-shared federal-provincial basis while the other two are funded entirely by the federal. See Figure IV for a display of the current distribution of sediment stations in the Atlantic Region. WRB will aim to obtain cost-sharing support from the province for a fifth base sediment station. **MEDIUM TERM GOAL.**

All 5 sediment zones now have at least one sediment station and such coverage will be maintained. Station mmanagement plans may dictate the transfer of sediment stations within a same zone, e.g. the Kennebecasis River gauge which has been monitoring suspended sediment in that basin for over 20 years. A station analysis report (SAR) has already been produced for the Kennebecasis River sediment station but its recommendations will only be implemented after a station management plan has been produced and confirmed the conclusions of the report.

The Narrows Mountain Brook sediment project station has long outlived its original use. It should be discontinued once SSTs and SMPs are completed and confirm this decision. **SHORT TERM GOAL.** Once the station is discontinued a SAR will be produced. **MEDIUM TERM GOAL.**

Due to the size and the importance of agricultural activity in the Saint John River Basin, the possibility of establishing a project sediment station on a watershed in that basin to monitor land activity influences on sediment loads and sediment quality will be explored. A possible location for such a station is the Holmes Brook watershed in the potatoe belt where a sediment study already took place in the 70's. Building and operating a hydrometric gauge at that site would have to be considered as part of the operating costs for the sediment station. WRB will canvass for such support. Such a project will only go forward if it receives financial support from outside sources such as Agriculture Canada the Water Quality Branch and the Province of New Brunswick. **MEDIUM TERM GOAL.**

3.2.2 Nova Scotia:

Currently, there are 2 sediment stations operated in Nova Scotia; 2 stations have been dropped in the past couple of years. The active stations are at Kelley River and Annapolis River @ Wilmot, and both are operated as federal stations. Both of the stations are in the same sediment zone. (See Figure IV) Another one of the province's sediment zones is shared with New Brunswick and it has a sediment station located at Coal Branch Stream. The other 3 zones are currently not being monitored for sediment data, and over the next three years (by the end of fiscal 1990-91), WRB will set out to establish sediment monitoring in all three of those zones. WRB will also vie to obtain support from the Nova Scotia Department of the Environment for the cost-sharing of those sediment stations. Should such support be unavailable, WRB will proceed on its own, but at a reduced scale. Some of the sediment zones may only receive miscellaneous sampling. **Medium Term Goal.**

The uncovered sediment zones in Nova Scotia are zones 7, 8, and 9 shown in Figure III. Possible monitoring sites to consider for these zones are the Sackville and Musquodoboit Rivers in zone 7, River Inhabitants and Salmon River @ Salmon River Bridge in zone 8, and the Northeast Margaree River in zone 9.

A station analysis report on the Annapolis River @ Wilmot sediment station has been produced but action on its recommendations will be defered until SSPs and SMPs for both of the active stations in the province have been completed. Once this is done it will be possible to identify if either or both of the stations should be discontinued. **SHORT TERM GOAL.** (This may seem like putting the cart before the horse but at least it will ensure the SMS course is followed). The resources freed up will be used to operate sediment station(s) in uncovered sediment zones.

3.2.3 Prince Edward Island:

Ingledow divided the Island into 2 sediment zones even though the erosive forces and the erodability were considered similar in both zones. For this reason, as shown in figure III, the Island will be considered as one sediment zone.

The Province of Prince Edward Island does not share in defraying the cost of the two sediment stations currently operated on the Island. A third station was operated until March 31, 1988 when the North Brook gauging station near Wall Road was discontinued. WRB will only support on its own one sediment station on the Island until all other sediment zones in the Atlantic Region are covered. It will also seek cost-sharing support from the province for the operation of that station. SSPs and SMPs will be completed for the two active stations, and then a decision will be made as to which station will be kept as a base station. **SHORT TERM GOAL.**

A SAR has been completed for the sediment station on the Wilmot River, but its recommendations will only be followed when a completed MP identifies the station objectives. Prior to discontinuing one of the sediment stations, WRB will seek financial support from the Province and other agencies such as WQB to operate on a project basis the station to be discontinued. **SHORT TERM GOAL.**

3.2.4 Newfoundland:

Sediment concentrations in Newfoundland rivers are usually extremely low and for this reason it is difficult to justify an elaborate sediment monitoring network. Nevertheless, in recent years, four sediment stations have been and are still being operated on a more or less ad hoc basis. Two of the stations are operated as provincial and two as federal-provincial.

Figure III shows the province as having five sediment zones, four on the Island and an all inclusive one for Labrador. The present sediment network has 3 of its 4 gauges in Zone 14 (western Newfoundland); the other one is located in Zone 11 (Avalon Peninsula). Two of the three zone 14 stations are financed by the province and the other one (Harrys River) is operated as federal-provincial. WRB will consult with the Province and propose a redistribution of the stations so that all four sediment zones on the Island have one sediment station. **SHORT TERM GOAL.**

One possibility is to keep the Highlands River (smaller basin, less stream storage) as a cost-shared base station in Zone 14. The two other stations would be discontinued after completion of the SSPs and SMPs and the resources freed would be used to establish stations in sediment zones 12 and 13. Possibilities for such stations in Zone 13 are Southwest Brook and Leech Brook, and in Zone 12, Grandy Brook and Tides Brook. Both these new stations would be cost-shared. **MEDIUM TERM GOAL.**

The Waterford River sediment station will be maintained as a cost-shared station for Zone 11 until completed SSPs and SMPs reveal sufficient data has been collected to move the station to another basin in the same zone. The station is in an urban growth area and this should not be overlooked when considering relocation. **SHORT TERM GOAL.**

3.2.5 Labrador:

Labrador is identified as one sediment zone. Sediment is judged to be even less of a factor here than on the Island. Nevertheless, WRB will look at the possibility of establishing an automatic base station. This will depend on financial resources available and will not be undertaken until all other sediment zones are covered. Should the province accept to cost-share such a station, the priority given will be accelerated. **LONG TERM GOAL**

3.2.6 Summary of Modifications to the Sediment Network:

Over the next three to five years the following changes to the present sediment station network are anticipated. These changes all relate to base stations and are based on the assumption all four provinces will agree to cost-share. Presently, the federal share of sediment station costs is 8.5 units while the four provinces contribute 5.5 units. With all the proposed changes implemented, the federal share would be reduced to 7.5 units while the provinces would have to increase their contribution to 7.5 units. The most important change will have to come from the Province of Nova Scotia which would have to up its ante from the present 0 contribution to a full 2 units. The other 3 provinces will be less affected.

New Brunswick:	- Discontinue 1 station - Obtain cost-sharing for 1 more station
Nova Scotia:	- Transfer 1 station to different zone. - Establish 2 new stations - Obtain cost-sharing on all 4 stations
Prince Edward Island:	- Discontinue 1 station - Obtain cost-sharing on 1 station
Newfoundland:	- Transfer 2 stations to different zones - WRB to cost-share 2 more stations
Labrador:	- Establish 1 new station - Cost-share new station

A possible second scenario for cost-sharing base sediment stations would be to adopt the same sediment station classification as that for the hydrometric stations. For example, a sediment station on the Kelley River would be classified federal while a possible station at Leech Brook would obtain a provincial classification.

As most stations in the Atlantic Region are either classified federal or federal-provincial, this way of proceeding would probably increase the present federal contribution by one or two station units. Adopting this procedure would however unduly tie the sediment monitoring programme requirements to those of the hydrometric programme. The two requirements may in some instances be complementary but not necessarily so. For this reason, the across the board 50/50 cost-sharing of base sediment stations is prefered to a cost-sharing based on the hydrometric classification.

Should cost-sharing of base sediment stations be declined in some instances, WRB will proceed to take sediment samples on a miscellaneous basis in every sediment zone without a base sediment station. A hydrometric station will be selected for this purpose and everytime the station is visited by a WRB technician, a sediment sample will be obtained. The values will be published as instantaneous values along with the regular sediment station data. **SHORT TERM GOAL.**

3.3 Technical Advisory Group(s)

The Washburn & Gillis Sediment Report proposed a national Technical Advisory Group (TAG) for the sediment programme. This group would have input and participation from all the regions. The Charlottetown workshop proceedings proposed the creation of an Atlantic Region Sediment Advisory Group with representation from WRB, WQB, TUNS, other universities, other C & P Branches, Departments of Agriculture, Research Institutes, etc. Although this group's role was seen more as an advisory board for the sediment programme co-ordinators, it did have similarities with the proposed national TAG. For this reason, the roles of the two groups will be merged into one but the implementation will be on a one TAG per province basis. Proceeding this way recognizes the four seperate cost-sharing agreements on water quantity surveys and will also facilitate the forming and working of these groups. Such an approach should ensure the individual provincial priorities are adressed.

Already, a TAG has been formed in the Province of Nova Scotia. Water Resources Branch will work towards the formation of similar groups in the other three provinces. **MEDIUM TERM GOAL.**

New Brunswick could be the next province to have an advisory group on sediment issues. WRB will convene a meeting with interested parties in that province to explore possible membership and terms of reference for such a group. **SHORT TERM GOAL.**

Water Resources Branch will propose that the technical advisory groups be involved in:

- defining and reviewing sediment station network objectives

- identifying and recommending network modifications

- identifying and proposing to the co-ordinators areas requiring special attention, e.g. a project sediment station

- identifying possible sources of funding

- informing WRB on technological and analytical developments

- proposing demonstration projects

The TAGs would meet on an as required basis but at least once a year. Once all four TAGs are formed, WRB will coordinate a joint meeting of the four groups to identify the areas of common ground, address common problems, and propose common solutions. **MEDIUM TERM GOAL.**

Water Resources Branch, Atlantic Region, will ensure its participation in a national TAG should one be formed and will encourage the participation of as many regional TAG members as possible at the national level. **MEDIUM/LONG TERM GOAL.**

3.4 Quality Assurance Programme

Water Resources Branch, Atlantic Region will implement a quality assurance programme (QAP) similar to the one already in place for the hydrometric programme. **MEDIUM TERM GOAL.**

Once the QAP audit elements for the sediment programme have been finalized at the national level, these elements will be used to produce audits yearly on the data of two sediment stations. These elements will have to address the question of theoretical values versus the field and laboratory results obtained. These audits will be conducted at the same time as the hydrometric data audits are performed. Pertinent results and recommendations will be included in a hydrometric and sediment data audit report submitted to the WRB Atlantic Chief. Pertinent recommendations will be forwarded for discussion and review to the TAG. **MEDIUM TERM GOAL.**

The TAGs will have as one of their roles to make recommendations dealing with the WRB sediment data publications, e.g. illiminating spurious accuracy by rounding off to the nearest 10 mg/l the suspended sediment concentration values orfor values below of 10 mg/l, using a symbol such as 'T' to signify a trace or insignificant quantity. Such recommendations would be brought forward for consideration at national meetings. **MEDIUM TERM GOALS.**

3.5 Data Dissemination

The 1986 Charlottetown workshop on sediment issues was useful in making the potential sediment data user community more aware of the sediment data already available. It also provided the workshop attendees the opportunity to point out the weaknesses in the data we produce. The measure of the workshop's success will be in how well WRB in co-operation with the provinces and other interested parties, responds to the needs expressed at the workshop.

All attempts at bettering the sediment monitoring programme must be accompanied by an effort to reach the potential data users. Also, the data colected and analysed must be provided in a manner to make the general public and those in decision making positions aware of the impact of the natural and man-made sediment processes. Already, a first effort has been made in that direction with the new format for the annual Sediment Data publication. The first new format publication came out for the 1984 WRB sediment data. Other national initiatives such as a new sediment Reference Index can be expected.

WRB Atlantic will aim at producing its annual data publication on a more timely basis. The goal will be to have the publication distributed within a few months after the Surface Water publication. This will require co-operation from the Water Quality Branch laboratory in completing the sediment sample analysis for a calender year by the end of the fiscal year. Such a schedule or as close to it will be negociated with the Water Quality Branch. **MEDIUM TERM GOAL.**

To increase the usefulness of the Sediment Data Publication, the SSP information will be stored on computer file format and be made available to the data users. The Region will ask the computerization procedures be handled at Headquarters by the end of 89/90. Otherwise, the Region will proceed on its own and complete this task by the end of 90/91. **MEDIUM TERM GOAL.**

WRB Atlantic will look at the possibility of producing a general interpretive report on the sediment processes in the Atlantic Region. The goal of this report would be to present the more general aspects of sediment but also to increase the awareness about the sediment monitoring programme and the availability of sediment data. The viability of producing such a document will depend on the completeness and representativeness of the existing data set. The possibility of producing this report co-operatively with the Water Planning and Management Branch and the Nova Scotia Department of the Environment will be looked into. **MEDIUM/LONG TERM GOAL.**

As a supplement to the interpretive report, a sediment fact sheet will be produced to promote the currently available suspended sediment data. The data gathered to produce the SSPs will be useful in producing such a sheet. **MEDIUM TERM GOAL.**

3.6 Ensuring Employee Training

Water Resources Branch, Atlantic Region will continue to update and upgrade both its technical and professional staff. The yearly Branch Training Plan will include an equitable allocation of resources for sediment related training based on the relative importance of the sediment programme and the identified needs to meet programme goals.

The Assistant Regional Engineer, the designated employee to oversee the sediment programme in the Atlantic Region, will obtain training from Headquarters in Hull in the producing of SSPs and SMPs. This training will then be transmitted to the technical staff. **SHORT TERM GOAL.**

The Technical Advisory Group will be requested to identify areas requiring additional training, e.g. for a specific study project. Management will consider these proposals and then decide on their inclusion in the Branch Training Plan.

Sediment data collection and computation training will be provided to the junior hydrometric technicians who did not attend the 1985 workshop in Moncton. WRB Atlantic will request Headquarters hold a similar workshop, on a regional or national basis for all technicians who require this training. Should the workshop be held in another region, the Atlantic Region technicians could travel to that region for the training. **MEDIUM TERM GOAL.**

The Atlantic Region Hydrology Division will assist in providing the necessary analytical expertise in the producing of interpretive studies, in proposing new sediment station locations, and in determining the adequacy of data sets. **ONGOING GOAL.**

The Atlantic Region will request from the Sediment Survey Section at Headquarters that technical field and office manuals be regularly reviewed and periodically updated. This would ensure methodological changes and technology changes are always reflected in the manuals in use.

WRB Atlantic will attend and participate in the proposed national sediment meeting set for the fall of '88 in Calgary. **SHORT TERM GOAL.**

4. OPERATIONS

4.1 Supervision of the Sediment Programme

Water Resources Branch, Atlantic Region, has designated the Assistant Regional Engineer as the employee responsible for overseeing the sediment monitoring programme in the region. This responsibility is expected to require in time the yearly equivalent of 0.1 PY. The Region does not foresee committing additional time as no further PY allocations have been received for sediment monitoring.

4.2 Sediment Station Profiles

The Sediment National Action Plan (SNAP) requires that each sediment station, both active and discontinued have a sediment station profile (SSP). SSPs will be produced for the active sediment stations by the end of fiscal 88/89. **SHORT TERM GOAL.** SSPs for discontinued stations with five or more years of record will be produced within the next three years. **MEDIUM TERM GOAL.** For the remaining discontinued stations, SSPs will be completed as time and resources permit. **LONG TERM GOAL.**

The SSPs will be similar and complementary to the hydrometric station profiles and will include all pertinent information on the basin characteristics upstream of the sediment station, the objectives of the station, and the type of data to be gathered. They will contain the information used to produce the yearly station management plans.

As stated in section 3.5, station profiles will be computerized to facilitate their completion, their use and their update.

4.3 Station Management Plans

A generic station management plan (SMP) form has been produced by Headquarters for use nationally and is already in use in a few regions. See appendix B for a copy of such a form. The Atlantic Region will implement its use for active stations as part of the station management system (SMS) by the end of fiscal 88/89. The Ottawa Sediment Section will provide the training and technical assistance necessary to produce the SMPs inhouse. **SHORT TERM GOAL.**

The SMP will be an important tool available to operate and manage effectively the sediment programme. It will have four major components: the station objective(s), an annual review, a historical review, and a work plan based on the station objective and the results observed in the annual and historical review. Its use will ensure stations are operated with clear goals in mind, and when these goals are attained, the status of the station can be re-evaluated and perhaps the resources can be allocated elsewhere.

Headquarters has requested the elctronic filing of the SMPs be handled in the respective Regions. The Atlantic region will aim to produce menu-driven and user friendly SMPs similar to what it proposes to do for the hydrometric station work plans.

The SMPs will reflect individual station requirements and station objectives will vary, but generally speaking, a more event oriented approach to suspended sediment sampling will be the modus operandi. Base stations will have as goal to monitor as completly as possible the sediment regime particularly during periods of high

suspended sediment concentration such as the spring freshet period, and during summer and fall events. Winter sampling will not be required unless the base station is specifically identified as a continuous data station. Sediment data will only be produced and published published to the extent it is collected and where it can reasonably be estimated.

4.4 Station Analysis Reports

When a SMP annual and historical review identify station objectives have been met and the station can be discontinued, a station analysis report (SAR) will be produced. **ONGOING GOAL.**

As mentioned in section 3.2, WRB Atlantic has already produced three SARs. If the SMS had been followed, each of these reports would have been completed only once a SMP yearly review had shown a station could be discontinued. Since SMPs have yet to be produced for any of the sediment stations, implementation of the SAR recommendations will be defered until the SMPs have been completed for those three stations.

SARs will be produced for the discontinued sediment stations with 5 or more years of record stations as time and human resources permit once the SSPs and SMPs have been completed for the respective stations. **LONG TERM GOAL.**

4.5 Equipment and Instrumentattion

Of the 14 active sediment stations in the Atlantic Region, three (Kelley, Harrys, and Highlands) are equipped with automatic sediment samplers. The first one is outfitted with the older type PWS-3 and prone to various malfunction problems. More portable, mechanically simple, and lightweight USPS82 samplers have been installed at Harrys River and Highlands River stations.

Testing and calibration in the Ontario Region 2 has demonstrated the USPS's reliability and performance in adequately reproducing manual sediment sampling for concentrations above 50 mg/l. Low suspended sediment concentrations in many of Atlantic Canada's streams and a high proportion of sandy particles may cause problems for the use of the USPS. The performance of the two USPS units wil be monitored. **MEDIUM TERM GOAL.**

If the results are satisfactory, serious consideration will be given to the purchase of additional USPS units for installation at the sediment stations in remote locations and those with smaller drainage areas. **LONG TERM GOAL.**

2) Memorandum - Synthese et discussion des resultats obtenus du PS-82 a la region d'Ontario. (F. Lapointe 86/01/22)

The Washburn & Gillis Sediment Report recommended that a station with a drainage area less than 100 km 2 be equiped with automatic sampling and this rule of thumb will be kept as a guideline. The future purchase of USPS units will depend on their monitored performance, but also on the sites selected for new or relocated sediment stations. Independantly of this, WRB will still plan for the purchase of one automatic sediment sampler per year for the next three years. This represents a capital investment of between 12k to 15k. **MEDIUM TERM GOAL.**

A Quality Assurance Programme will be implemented to ensure the correct methodology is used for sediment sample collection and data computation. Until the programme is finalized, directives, e.g. the use of a verified single representative vertical for the depth integrated samples, will be sent to the technical staff. **SHORT TERM GOAL.**

The individual station management plans will include sampling frequency coverage which takes into consideration the sharpness and duration of basin flow peaks. See Table II, extracted from the Washburn & Gillis Sediment Issues report, for suggested sampling intervals. **MEDIUM TERM GOAL.**

5. RESEARCH AND SEDIMENT ISSUES

The Water Resorurces Branch, through its Water Survey of Canada Division, is primarily a surface water data collection organization and with its Hydrology Division it has a subsidiary and complementary role in data interpretation. From this perspective, Branch sediment research requirements are primarily in improving its data collection and interpretation capabilities. WRB Atlantic also considers it has a co-operative and supportive role in specific sediment issue monitoring and studies and in advancing the knowledge of the sediment processes and effects in the region.

5.1 Operations Related Research

The Branch systematically collects data, mostly hydrometric but also sediment, via an extensive gauging station network based on cost-sharing agreements with the four Atlantic Provinces. To better respond to this task, it has identified areas where technological and methodological develpments are required or would be beneficial. They are:

- Multi-parameter concentration curves. Ideally, relationships between stage and suspended sediment concentrations should be as well defined as those for discharge. E.g., C=f(rising limb, falling limb)
  C=f((rise in stage)/T)
  C=f(season, antecedant erosion index *)

  * based on station profile upstream conditions

- A turbidity Meter. Efforts should be concentrated on making such an instrument more reliable for concentrations below 50 mg. Otherwise, its use in the Atlantic Region would be limited.

- Deterministic and stochastic methods of analysis to better define the frequency and duration of a sampling programme.

- Development of multiple regression relationships to correlate sediment yield with watershed physiographic and long term hydrometric parameters.

- A study on the method and validity of estimating the magnitude of the sediment concentration peaks.

The above research and development requirements will be proposed for inclusion in a national sediment research and development plan. LONG TERM GOAL.

The limited HQ resources may hinder progress and completion of such research projects, but some of them might be channelled to one of our research institutes or even contracted out depending on the priority given to the project. From an Atlantic perspective, the development and successful testing of a low concentration turbidity meter should be given top priority.

5.2 Sediment Issues Monitoring

In Canada, the provinces retain most of the jurisdiction over rivers within their boundaries; the federal does have jurisdiction over certain matters such as fisheries and navigational questions. Due to this predominant provincial jurisdiction over the water resource (sediment is a physical component of this resource), initiating issue oriented sediment research must be seen as mainly a provincial responsibility. The Water Resources Branch will play a co-operative and supportive role in any research studies or projects instigated by the province(s) or by outside organizations via the provincial co-ordinators. An example of such a project would be sediment monitoring on the Little Sackville River alluded to in the recently approved 1987 5-year Nova Scotia Hydrometric Plan.

WRB is interested in lending its support to other federal programme research projects which relate to federal water responsibilities, e.g. the protection of the fish habitat. This support, however, would normally be on a basis of cost-recovery, and consist of providing technical sevices and professional expertise.

The sediment Technical Advisory Group(s) (TAG) will be expected to play a major role in identifying these research needs, in proposing projects to answer those needs, and in promoting the projects at the co-ordinator level. Outside agencies will be required to submit their research requirements first of all to the

TAG (if one exists) and or to the provincial coordinators, who, if they agree with the requests, would in turn request at a co-ordinating committee meeting the projects be included in the WRB work plan.

The Charlottetown workshop recommended several fields of possible sediment investigation. These are not projects in which WRB has a direct interest but it would be willing to participate as a data collection agency. The following list is an example of such projects:

- Effect of short term high sediment concentrations on fish
- Impact of development on the natural sediment regime
- Monitoring sediment production upstream of an aquatic facility
- Soil loss monitoring and conservation study
- Locating sediment sources and identifying their processes
- Water quality linkage to the presence of sediments
- Effect of silting on small hydro facilities.
- Role of sediment fines in the transport of herbicides.

5.3 Research Project Co-operation and Co-ordination

The formation and composition of the TAGs will to a large extent determine sediment research activity. The TAG is seen as the precursor, advisor, and the actual co-ordinator of any sediment research or issue oriented monitoring activity undertaken within the region. TAG members would also be expected to contribute in their advisory role tonational research activity.

WRB Atlantic does not foresee a sudden and major explosion of research activity in the field of sediment, either at the regional or national level. Regional interest in sediment processes or problems is still marginal (there are exceptions) and allocated budgets make it difficult to go beyond just maintaining the status quo. Notwithstanding this perspective, WRB Atlantic commits itself to participating in national sediment research efforts to the best of its capability and financial capacity. LONG TERM GOAL.

APPENDIX A

Figures and Tables

FIGURE I

STATION MANAGEMENT SYSTEM (SMS)

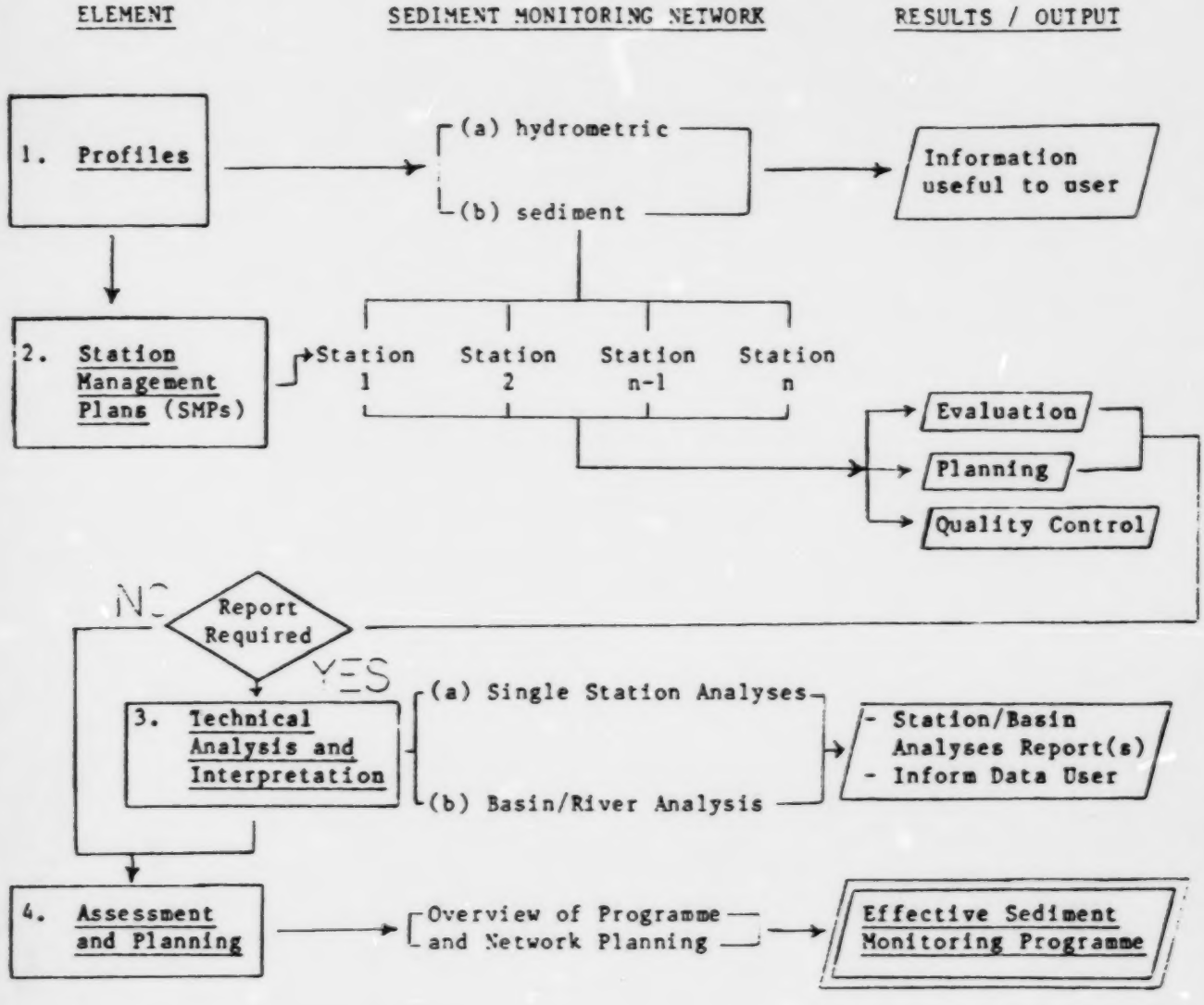

FIGURE 11 - INGLEDOW SEDIMENT ZONES

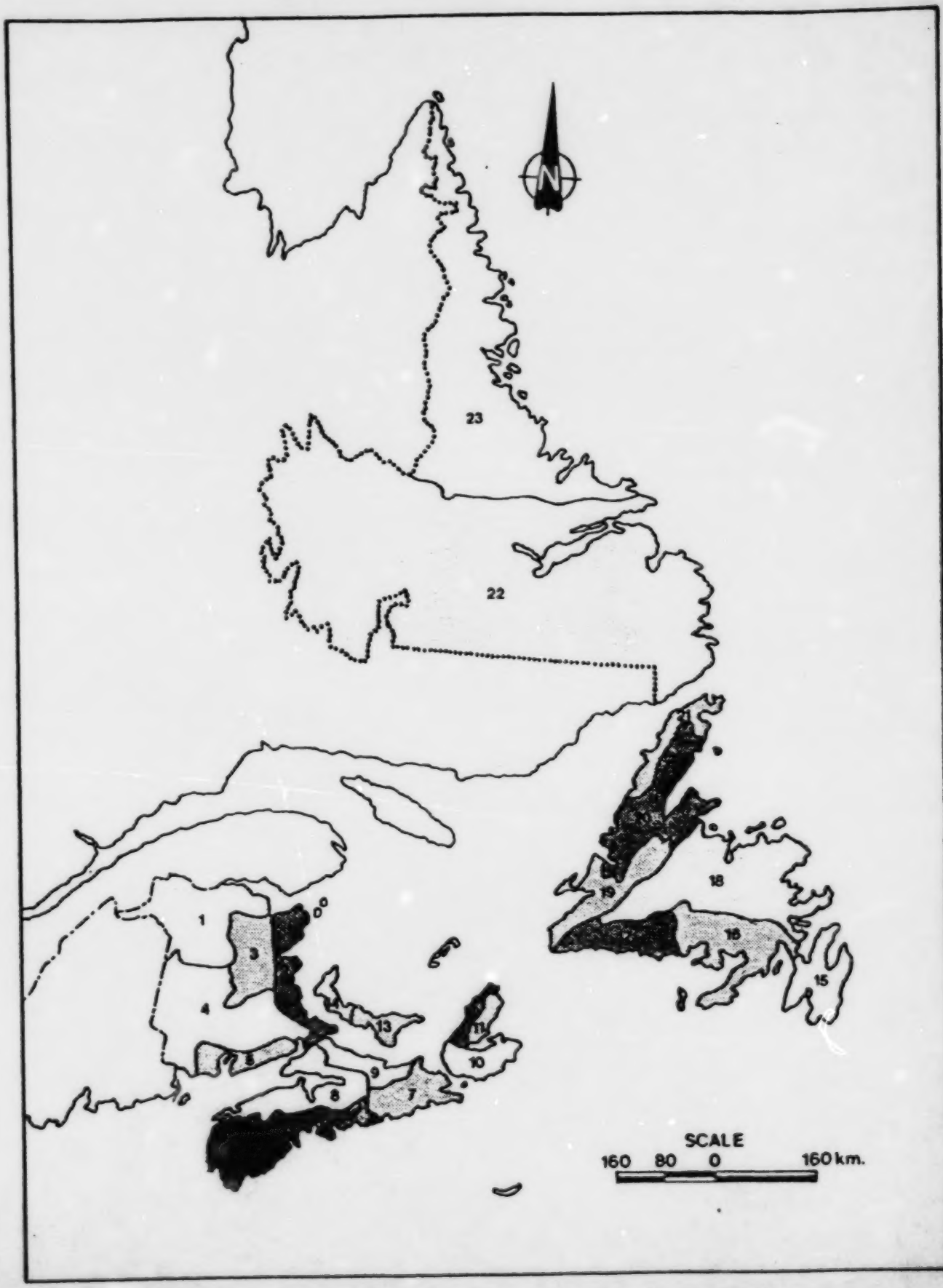

FIGURE III - S.A.P. 15 ZONE DELINEATION

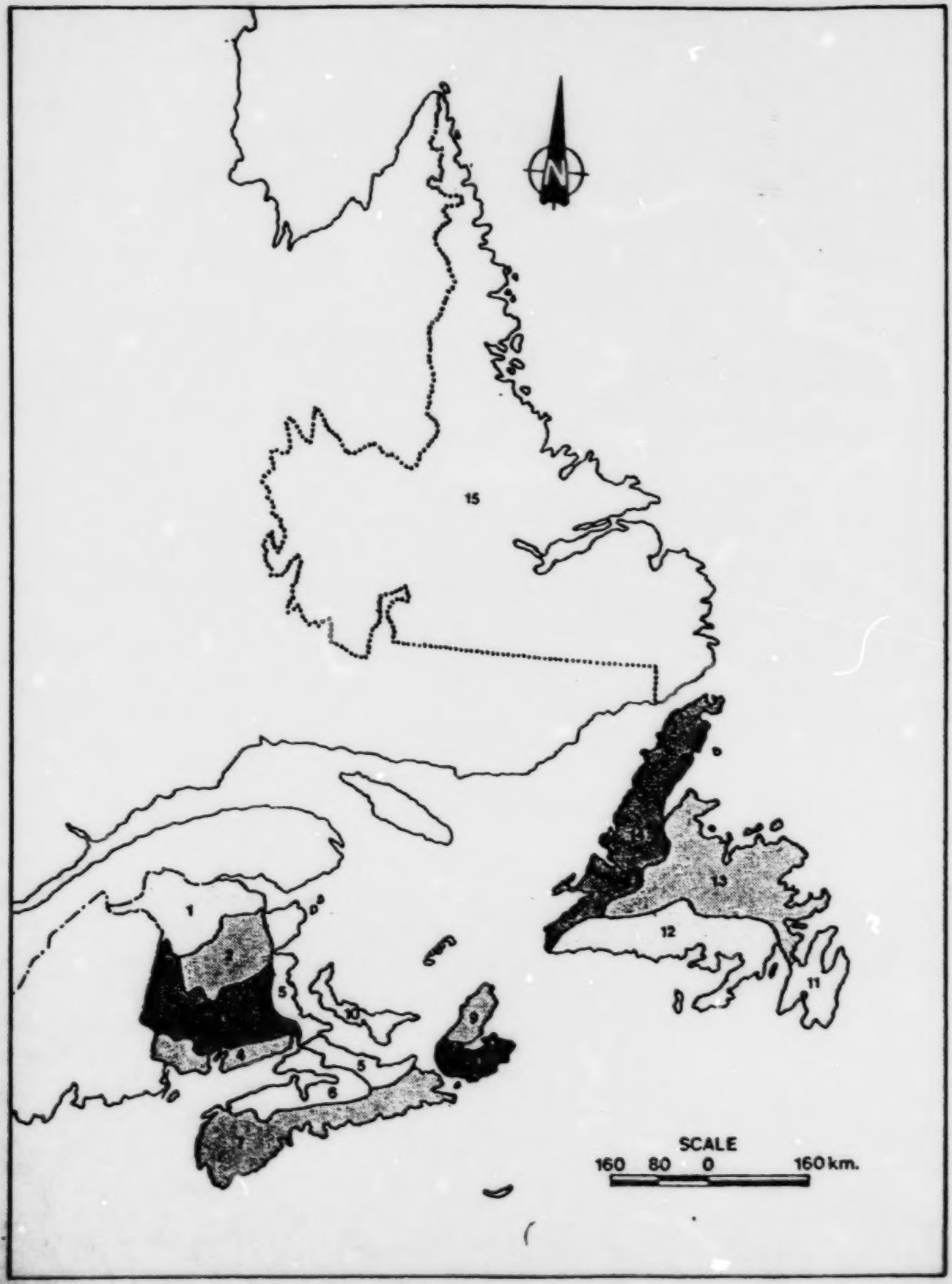

FIGURE IV - CURRENT SEDIMENT NETWORK

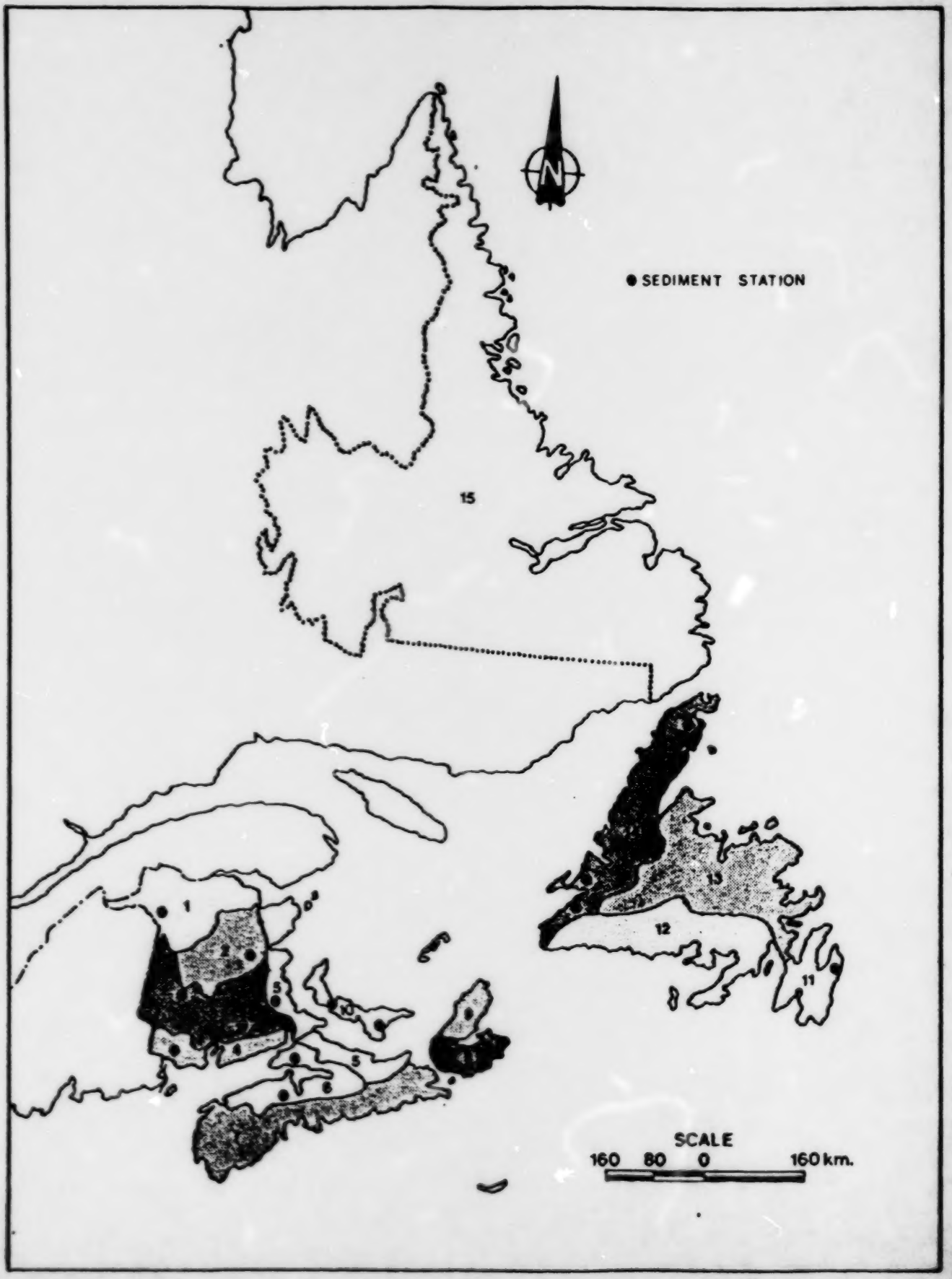

TABLE I

SEDIMENT ZONE DISTRIBUTION PER PROVINCE

New Brunswick	4 +1 *
Nova Scotia	4
Prince Edward Island	1
Newfoundland	4
Labrador	1

* Zone common to both provinces.

Total No. of Sedment Zones ... 15

TABLE II

Suggested Sampling Frequency for Estimating Suspended Sediment Load

CONTRIBUTORY AREA	Δt DURING PEAK FLOWS	COMMENT
Field Plot	-	Trap Fraction of Sediment Outflow
<1 km^2	0.25 - 1 hour	Automatic Sampling
1 - 10 km^2	1 - 3 hours	Automatic Sampling in Most Cases
10 - 100 km^2	3 - 6 hours	Automatic or Manual Sampling (Automatic Sampling Preferred)
100 - 1000 km^2	6 - 12 hours	Manual Sampling
>1000 km^2	12 hours	Manual Sampling

Notes:
1. These values of sampling frequency are only tentative guidelines; however, they do point to the fact that good estimates of suspended sediment load are dependent upon appropriate Δt.
2. The time at which Δt values are to be shortened is site dependent and can be related to stage.

APPENDIX B

Summary of Goals

SHORT TERM GOALS

GOAL 1 Discontinue the Narrows Mountain Brook sediment station after sediment station profiles and station management plans completed. (p.5, 3.2.1)

GOAL 2 Decide on status of Annapolis and Kelley River stations. Annapolis station analysis report recommendations on hold until after sediment station profiles and station management plans completed. (p.5, 3.2.2)

GOAL 3 Discontinue one of the PEI sediment stations once completed sediment station profiles and station management plans identify which station to keep. Seek cost-sharing from province for operation of the remaining station as part of the base network. (p.6, 3.2.3)

GOAL 4 Use Wilmot station analysis report to make decision, but only if recommendations are in line with a completed station management plan which identifies the station objectives. Inquire about other sources of support prior to discontinuing second PEI station. (p.6, 3.2.3)

GOAL 5 Consult with Province of Newfoundland and propose a redistribution of the stations so that all four sediment zones on the Island will have one sediment station. (p.6, 3.2.4)

GOAL 6 Maintain the Waterford River station as a cost-shared station until sediment station profile and station management plan reveal sufficient data collected. (p.7, 3.2.4)

GOAL 7 Convene a meeting of interested parties to explore possibility of forming a sediment technical advisory group for the province of New Brunswick. (p.8, 3.3)

GOAL 8 Attend and participate in the proposed national sediment meeting set for the fall of '88 in Calgary. (p.11, 3.6)

GOAL 9 Produce sediment station profiles for the active sediment stations. (p.12, 4.2)

GOAL 10 Implement the use of station management plans for active stations. (p.12, 4.3)

GOAL 11 Issue quality control directives, e.g. the use of a verified single representative verticle for depth integrated sampling. (p.14, 4.5)

MEDIUM TERM GOALS

GOAL 12 Aim to obtain cost-sharing support from New Brunswick for a fifth base sediment station. (p.4, 3.2.1)

GOAL 13 Produce a station analysis report for the discontinued Narrows Mountain Brook station. (p.5, 3.2.1)

GOAL 14 Inquire about outside support to establish and operate a project sediment station on a Saint John River Basin watershed to monitor land activity influences on sediment loads. (p.5, 3.2.1)

GOAL 15 Set out to establish sediment monitoring in the three uncovered sediment zones in Nova Scotia. Provincial cost-sharing support will determine extent of monitoring. (p.5, 3.2.2)

GOAL 16 Implement redistribution of base sediment stations on the Island of Newfoundland. (p.6, 3.2.4)

GOAL 17 Implement miscelleaneous sediment sampling in sediment zones where provinces do not support cost-sharing of base station sediment monitoring. (p.8, 3.2.6)

GOAL 18 Work towards the formation of sediment technical advisory groups in all four provinces. (p.8,3.3)

GOAL 19 Coordinate a joint meeting of the technical advisory groups. (p.8, 3.3)

GOAL 20 Implement a sediment quality assurance programme. (p.8, 3.4)

GOAL 21 Conduct first yearly audit of data produced at two sediment stations. (p.9, 3.4)

GOAL 22 Request technical advisory groups make recommendations for national standards. (p.9, 3.4)

GOAL 23 Produce the annual data publication on a more timely basis. (p.10, 3.5)

GOAL 24 Produce a computerized format for the sediment station profiles. (p.10, 3.5)

GOAL 25 Produce a sediment fact sheet. (p.10, 3.5)

GOAL 26 Provide the junior hydrometric technicians who did not attend the 1985 workshop in Moncton with sediment data collection and computation training. (p.11, 3.6)

GOAL 27 Produce sediment station profiles for discontinued stations with five or more years of record. (p.11, 4.2)

GOAL 28 Monitor the performance and reliability of the automatic USPS for low concentrations (< 50 mg/1). (p.13, 4.5)

GOAL 29 Purchase one automatic sediment sampler per year for the next three years. (p.14, 4.5)

GOAL 30 Develop station sampling programmes according to basin characteristics. (p.14,4.5)

MEDIUM/LONG TERM GOALS.

GOAL 31 Ensure WRB Atlantic participation in a national sediment tecnical advisory group should one be formed. (p.9, 3.3)

GOAL 32 Produce a general interpretive report on the sediment processes in the Atlantic Region. (p.10, 3.5)

LONG TERM GOALS

GOAL 33 Establish an automatic base station in Labrador. (p.6, 3.2.5)

GOAL 34 Produce sediment station profiles for the remaining discontinued stations. (p.12, 4.2)

GOAL 35 Produce station analysis reports for the discontinued sediment stations with 5 or more years of station record. (p.12, 4.4)

GOAL 36 Purchase additional USPS units for sediment stations in remote locations and for those with smaller drainage areas. (p.13, 4.5)

GOAL 37 Propose projects for a national research and development plan. (p.15, 5.1)

GOAL 38 Participate in national sediment research efforts to the best of its capability and financial capacity. (p.16, 5.2)

ONGOING GOALS

GOAL 39 Assistant Regional Engineer to oversee the sediment programme in the Atlantic Region. (p.11, 3.6)

GOAL 40 Hydrology Division to provide analytical expertise for the sediment programme. (p.11, 3.6)

GOAL 41 Produce a station analysis report as a station is discontinued. (p.13, 4.4)

APPENDIX C

Station Management Plan Form

STATION MANAGEMENT PLAN

STATION NO. _____

NAME: _____

LOCATION: Latitude _____
Longitude _____

SAMPLING STRATEGY. _____ Continuous
_____ Seasonal
_____ Miscellaneous
_____ Special Event

DATA OUTPUT: _____ Load
_____ Suspended Sediment Concentration
_____ Suspended Sediment Particle Size
_____ Bed Material
_____ Bed Load
_____ Dissolved Solids
_____ Temperature

STATION OBJECTIVE(S)

STATION NO. _____

HISTORICAL REVIEW

PART I - FLOW & CONCENTRATION DATA

1. Year Range ( ): ____ to ____
2. Total number of SSC Samples: _____
3. Number of SSC Measurements (5 vert.): _____
4. Max. ( ) flow, Q: _____ m^3/s
5. Min. ( ) SSC: _____ mg/L with Q: _____ $m^3 3/s$
6. Max. ( ) SSC: _____ mg/L with Q: _____ m^3/s
7. Gaps in Flow range of sample coverage: ____ to ____ m^3/s
   ____ to ____ m^3/s
   ____ to ____ m^3/s
   ____ to ____ m^3/s

PART II - SUSPENDED PARTICLE SIZE DATA

8. Total number of Depth Integrating Particle Size Samples: _____
9. Number of Depth Integrating Particle Size Measurements: _____
10. Number of Point Integrating Measurements: _____
11. Number of Point Integrating Samples: _____
12. Range in percent content; Clay/Silt: _____ to _____ %
    Sand: _____ to _____ %
13. Range of SSC (Particle Size): _____ to _____ mg/L
14. Range of Flow (Particle Size): _____ to _____ m^3/s

PART III - BED MATERIAL DATA

15. Number of Bed Material Samples: _____
16. Number of Bed Material Measurements: _____
15. Range of percent content; Clay/Silt: _____ to _____ %
    Sand: _____ to _____ %
    Gravel: _____ to _____ %

STATION NO. _____

ANNUAL REVIEW

REVIEWED BY: _____ YEAR: _____

PART I - FLOW & CONCENTRATION DATA

1. Total number of SSC Samples: _____

2. Number of SSC Measurements (5 vert.): _____

3. Min. ( ) SSC: _____ mg/L with Q: _____ m^3/s

4. Max. ( ) SSC: _____ mg/L with Q: _____ m^3/s

5. SSC Samples nearest freshet peak; Conc.: _____ mg/L
   with Q: _____ m^3/s
   Qpeak: _____ m^3/s

6. Number of SSC Samples on rising freshet limb: _____

7. Number of SSC Samples on falling freshet limb: _____

8. Flow range of SSC Sample coverage: _____ to _____ %

PART II - SUSPENDED PARTICLE SIZE DATA

9. Total number of Depth Integrating Particle Size Samples: _____

10. Number of Depth Integrating Particle Size Measurements: _____

11. Range in percent content; Clay/Silt: _____ to _____ %
    Sand: _____ to _____ %

12. Range of SSC (Particle Size): _____ to _____ mg/L

13. Range of Flow (Particle Size): _____ to _____ m^3/s

PART III - BED MATERIAL DATA

14. Number of Bed Material Samples: _____

15. Number of Bed Material Measurements: _____

16. Range of percent content; Clay/Silt: _____ to _____ %
    Sand: _____ to _____ %
    Gravel: _____ to _____ %

STATION NO. ___/___

WORK PLAN RECORD

1988 WORK PLAN

Supervisor: _____ Date: _____

Field Person: _____ Most Recent Data: _____

COMMENTS:

EVALUATION OF ____ WORK PLAN

Supervisor: _____ Date: _____

Field Person: _____

COMMENTS:

STATION NO. _ ____ _____

PLOTS

1. Discharge vs
   Time (%) Data Equalled or Exceeded / Sample Coverage.
   UPDATED (YR): _____

2. Depth Integrating Particle Size vs. Percent Finer
   UPDATED (YR): _____

3. Bed material vs. Percent Finer
   UPDATED (YR): _____

4. Max. Annual Discharge vs.
   Recurrence Interval in Years
   UPDATED (YR): _____

5. Discharge/SSC vs. Time

6. Rating curve:
   SSC vs. Discharge

Daily Data	Instantaneous Data

STATION NO. _____

TABLES

Updated (YR)

1. Summary of Suspended Sediment Samples

2. Depth Integrating Particle Size Analysis of Suspended Sediment

3. Particle Size Analysis of Bed Material

APPENDIX D

The 14 Sediment National Action Plan Elements

SEDIMENT NATIONAL ACTION PLAN

1. WRB re-affirms its support for physical sedimentation as the basis for the existing and future programme.

   - Follow finalized Results-Definition Model. WRB responsibility.

2. WRB must respond to the current demands for advice and information on problems and issues.

   - Each District will develop and acquire appropriate technical competence to lead its sediment work by identifying 1 py in each District for this purpose. Regional responsibility.

   - Utilize IWD institutes for undertaking studies where appropriate. HQ responsibility.

3. Each Region of WRB will prepare action plans consistent with this action to be approved by Regional Directors.

   - WRB managers will use Results-Definition Model of Sediment Survey Programme as their guide to the mandate, expected results, strategies, and activities in preparing their action plan. Regional responsibility.

   - Three year action plans to be drawn up regionally and nationallly. Recommendations from "issues" reports to be studied and implemented where considered possible. Regional responsibility.

4. WRB is to participate in IWD Sediment Task Force to assist in defining activities in IWD.

   - Task Force to complete excercise. Task Force responsibility.

   - WRB to complete Branch Results Definition Model for Sediment Survey Programme. Final version will be completed at termination of Task Force work. HQ, WRB responsibility.

5. WRB is to respond more specifically to the needs of environmental applications of sediment data, expertise, and information.

   - Revamped publications. HQ responsibility.

   - Workshops to bring together wide range of possible users. Regional responsibility.

   - New sediment Reference Index needed to provide info on both WSC and other sources of data. HQ responsibility.

6. WRB is to assess possible relationships between Sediment Survey and Water Quality programmes.

   - Identify sediment linkages between WRB & WQB and implement appropriate joint activities. WRB/WQB responsibility.

7. WRB will complete the national assessment of sediment issues.

   - Report for NWT needs to be done. WNR responsibility.

8. Ensure network planning includes interests of agencies and appropriate individuals.

   - Establish communications with interested parties and potential users. HQ responsibility.

9. Network evaluation is a continuing activity and network plans are to be kept current.

   - Evaluation procedures and techniques to be developed. HQ responsibility.

   - Network plans to be developed in all Regions. Regional responsibility.

10. To implement a system for managing sediment stations like projects to enable Regions to undertake systematic evaluation, planning, and operation of data collection activities.

    - Design of WRB station profile, including specific purpose, client, data use, etc to be completed and implementation begun. HQ/Regional responsibility.

    - Sediment station management system to be designed and implemented. Emphasis on flexibility required. HQ/Regional responsibility.

11. Improve basic data publications. HQ responsibility.

12. Assess the need for hydraulic and morphologic data to support sediment studies.

    - An assessment of needs and applications of "other data" should consider the hydraulic and morphologic needs. HQ responsibility.

    - Evaluate the recommendations resulting from the above noted study in context of Branch priorities, and develop a policy statement. HQ/Regional responsibility.

13. Investigate feasibility of developing a national reference index of Sediment data bases in Canada.

    - Identify sources of information and data and provide these references to users. HQ/Regional responsibility.

14. WRB to implement specific technical improvements towards management of sediment activities.

    - Implement a quality assurance programme. HQ/Regional responsibility.

    - Establish a systematic equipment evaluation, design, and calibration procedure. HQ responsibility.

    - Evaluation of sampling methods to acertain appropriateness, accuracy, and precision in relation to end use. HQ responsibility.

    - Undertake selected joint projects with other agencies to investigate effectiveness of, and problems with integrated sediment activities. HQ/Regional responsibility.

    - Conduct data analysis and interpretations including thorough assessment of long-term records, in order to maximize information content of data and to guide programme changes. Regional/HQ responsibility.

APPENDIX E

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